

Mathematics Omobolanle
 15/10/22
 Civil Engineering

300 level

$$x^2 y'' + 2xy' + y = 0$$

$$x^2 y'' + 2xy' + y = 0$$

1st product

$$x^2 y''$$

$$v = x^2 \quad v' = 2xc \quad v'' = 2 \quad v''' = 0$$

$$u = y'' \quad u^{(n)} = y^{n+2}$$

$$y = u^{(n)} v + n u^{(n-1)} v' + \frac{n(n-1)}{2!} u^{(n-2)} v'' + \frac{n(n-1)(n-2)}{3!} u^{(n-3)} v'''$$

$$y = y^{n+2} \cdot 2 + n y^{(n+1)} \cdot 2xc + \frac{n(n-1)}{2 \times 1} u^{(n-2)} \cdot 2 + \frac{n(n-1)(n-2)}{3 \times 2 \times 1} u^{(n-3)} \cdot 0$$

$$2y^{n+2} + 2nxy^{(n+1)} + n(n-1)y^{n+2} + 2n^2 y^{n+1} + n(n-1)y^n$$

2nd Product

$$xy'$$

$$v = xc \quad v' = 1 \quad v'' = 0$$

$$u = y' \quad u^{(n)} = y^{n+1}$$

$$= u^{(n)} v + n u^{(n-1)} v' + \frac{n(n-1)}{2!} u^{(n-2)} v''$$

$$= y^{n+1} \cdot xc + n y^{n+1} \cdot 1 + n(n-1) y^n \cdot 0$$

y

$$v = 1 \quad v' = 0$$

$$u = y \quad u^{(n)} = y^n$$

$$= u^{(n)} v + n u^{(n-1)} v'$$

$$= y^n \cdot 1 + n y^{n-1} \cdot 0$$

$$= 2y^{n+2} + 2nxy^{(n+1)} + n(n-1)y^n + 2n^2 y^{n+1} + n(n-1)y^n$$

$$= 2y^{n+2} + (2n+1)xy^{n+1} + y^n(n^2+1) = 0$$

Makaryuola Omobolanle

15/ENR 03/022

Civil Engineering

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$$2) y = 2x^3 + 4x^4$$

$$v = x^3$$

$$u = x^4$$

$$v' = 3x^2$$

$$u' = 4x^3$$

$$v'' = 6x$$

$$v''' = 6$$

$$v^{(4)} = 0$$

Using Leibnitz Theorem.

$$y^{(n)} = u^{(n)}v + n u^{(n-1)}v' + \frac{n(n-1)}{2!} u^{(n-2)}v'' + \frac{n(n-1)(n-2)}{3!} u^{(n-3)}v'''$$

$$y^{(3)} = 4^n x^n + n \cdot 4^{n-1} x^{n-1} + \frac{n(n-1)}{2!} 4^{n-2} x^{n-2} + \frac{n(n-1)(n-2)}{3!} 4^{n-3} x^{n-3}$$

$$+ \frac{n(n-1)(n-2)}{4!} 4^{n-4} x^{n-4}$$

$$y^{(5)} = 3 \cdot 4^3 x^3 + 3 \cdot 4^2 x^2 + n(n-1) 4^{n-2} x^{n-2} + 3 \cdot 4 x + n(n-1)(n-2) 4^{n-3} x^{n-3}$$

$$y^{(5)} = 3 \cdot 4^3 x^3 + 3 \cdot 4^2 x^2 + 5(5-1) 4^{5-2} x^{5-2} + 3 \cdot 4 x + 5(5-1)(5-2) 4^{5-3} x^{5-3}$$

$$y^{(5)} = 1024x^3 + 3840x^2 + 3840x + 960$$

Makanyola Omobolanle

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$$y = e^{2x+2}$$

$$v = 1, v' = 0$$

$$u = e^{2x+2}, u^n = (2x+1)^n e^{2x+2}$$

$$y' = u^n \cdot v + 0$$

$$y' = (2x+1)^n e^{2x+2}$$

from y'

$$v = 2x+1, v' = 2, v'' = 0$$

$$u^n = (2x+1)^n e^{2x+2}$$

$$y'' = u^n \cdot v + n u^{(n-1)} v' + 0$$

$$y'' = (2x+1)^n e^{2x+2} + n(2x+1)^{n-1} e^{2x+2}$$

$$y'' = (2x+1)^n e^{2x+2} \cdot (2x+1 + n(2x+1)) e^{2x+2}$$

sub into eqn

$$y'' = y'(2x+1) + 2y$$

$$y'' =$$

$$y'' = y'(2x+1) + 2y$$

where $w = y''$

$$y'' = y'(2x+1) + 2y$$

$$u = 1, v = 1$$

$$w = y''$$

$$w^n = u^n \cdot v + 0$$

$$w^n = y''$$

where $w^n = y''$

$$v = 2x+1, v' = 2, v'' = 0$$

$$u = y', u^n = y^{(n+1)}$$

$$w^n = u^n \cdot v + n u^{(n-1)} v' + 0$$

$$w^n = y^{(n+1)} \cdot (2x+1) + n y^{(n+1)-1} \cdot 2$$

$$w^n = (2x+1) y^{(n+1)} + 2n y^n$$

where $w = 2y$

$$v = 2, v' = 0$$

$$u = y, u^n = y^n$$

MAKANTJOLA Omobolanle

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$$w^n = y^n + 0$$

$$w^n = 2 \cdot y^n$$

$$y^n = y^{(n+2)} - (y^{(n+1)} (2n+1) + n^2 y^n) - 2y^n = 0$$

$$y^{(n+2)} = y^{(n+1)} (2n+1) + n^2 y^n + 2y^n$$

$$y^{(n+2)} = (2n+1) y^{(n+1)} + 2y^n (n+1)$$